(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 769 733 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.04.1997 Bulletin 1997/17

(51) Int. Cl.[6]: **G04B 19/22**

(21) Application number: **95307392.1**

(22) Date of filing: **18.10.1995**

(84) Designated Contracting States:
CH DE FR GB IT LI

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(54) Timepiece

(57) A timepiece (1) provides the user's local time and local GMT times in other locations. Twenty four countries, one for each GMT time zone, are marked on a city dial (5) rotated clockwise by the hour hand mechanism once every twelve hours. The cities in time zones 0100-1200 and 1300-2400 are on outer and inner city rings (5b,5a) respectively, with a twelve hour time difference between opposed cities on the rings. The local GMT time of a city is obtained from the city's position relative to time graduations on an outer hour dial (6) and an inner hour dial - the watch face (2). The outer dial (6) may be replaced by suitable time markings on the watch face (2). The positions of the cities and time graduations may be swapped. The annular dial (5) may be replaced by a disc transparent at its centre. The city dial 5 may rotate anticlockwise instead of clockwise with suitable changing of the markings. The rotating dial (5) may be rotated manually, instead of by the hour hand mechanism, whenever a time check is required. Upper and lower quarter dials (10,11), seen through openings (8,9), rotate a quarter turn once every six hours to indicate the time period of the day. A mechanism is disclosed for driving the city dial (5) and the two quarter dials (which may be replaced by hands) from the hour hand mechanism.

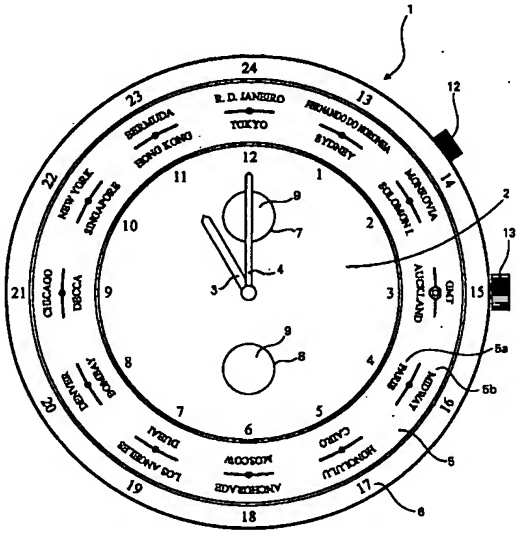

FIG. 1

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Description

The present invention relates to timepieces, such as clocks and watches and other horological instruments, and relates especially to timepieces which give both the present time of a specific location, normally that of the wearer, as well as the local times of a number of other location worldwide. Such timepieces are often called "world clocks" or "universal timepieces".

US-A-4634287 and US-A-5383165 both disclose such a timepiece comprising a conventional fixed clock face and hour and minute hand mechanisms, together with a universal time indicator.

In US-A-4634287, the universal time indicator comprises a disc mounted in the middle of the clock face, which rotates clockwise once every twenty-four hours. The disk has 1-24 time graduations marked about its outer edge, and opposing these on the inner edge of the fixed clock face are geographical location names corresponding to different GMT time zones.

In US-A-5383165, the universal time indicator comprises two annular dials mounted about the clock dial. The inner annular dial rotates counter-clockwise once every twenty four hours and has 1-24 time graduations marked thereon. The outer annular dial is fixed and has geographical location names thereon again corresponding to different GMT time zones.

In both cases, the local time in each location can be read from the time graduations marked on the rotating disc or dial opposite to the location name. In both cases, the positions of the geographical names and the time-markings could be interchanged.

Other types of universal timepieces are disclosed in EP-A-488114, US-A-4222227, US-A-4579460 and EP-A-214293.

The present invention aims to provide an alternative universal timepiece to those above, which may be easily read.

Viewed from one aspect, the present invention provides a timepiece for providing the local GMT time in a number of locations worldwide, comprising:

a hour hand;
fixed dial means;
rotatable dial means;
time graduation means comprising inner and outer time rings, with time graduations 0100-1200 being arranged on one of the time rings and time graduations 1300-2400 being arranged on the other of the time rings; and
location indicating means comprising inner and outer location rings, a location for each of the GMT time zones 0100-1200 being provided on one location ring and a location for each of the GMT time zones 1300-2400 being provided on the other location ring;
said two time rings or said two location rings being provided on said rotatable dial means, with the other of the two time or location rings being provided on the fixed dial means.

The timepiece will normally have a standard clock face with time graduations 1-12 thereon to which the hour hand and a minute hand may point to provide the correct local time.

By the invention, the local GMT time of a location marked on one or the other of the location rings may be obtained from a time graduation, on one of the time rings, which that location opposes, as discussed later.

In one embodiment, the location rings are provided on the rotatable dial means, and the rotatable dial means is in the form of an annular dial about the clock face, the annular dial rotating clockwise once every twelve hours with the hour hand (the time rings may be provided on the clock face). In this embodiment, the rotatable dial is set so that the location corresponding to the location of the time piece is pointed to by the hour hand. The other locations on the location rings are then automatically opposite the correct time graduation corresponding to their local GMT times. Actually, each location is opposite to two time graduations, the correct one and one having a twelve hours difference (i.e. one on each of the inner and outer time rings), and in order to determine which of the two is correct, one of a number of methods may be used, as discussed later and in the description of the specific embodiments.

The invention contrasts with the prior art, in that it does not use a single twenty four hour time dial or a single twenty four GMT location dial, rotating once every twenty four hours. Rather, it divides the twenty four GMT time zones and the 0000-2400 hours into two sets of twelve. This can provide a number of advantages, and allows the locations and time graduations to be written on the timepiece in an uncluttered fashion. Further, as in the above-mentioned embodiment, as there are only twelve locations per ring, the rotating dial is able to rotate at the same speed as the hour hand (i.e. once every twelve hours). This is especially advantageous when the location rings are provided on the rotatable dial, as the location for which the hour hand tells the correct time is usually also marked on one of the location rings, and by this embodiment the location will always be pointed to by the hour hand. This latter feature emphasises the correct time for that location, and contrasts with the prior art in which the location of the timepiece as marked on the universal indicator is not usually pointed to by the hour hand, which can be disconcerting.

As said, when the location rings are provided on the rotatable dial, the two hour rings may be provided on the clock

face of the timepiece (the clock piece acting as the fixed dial means). The 1-12 time graduations of the normal clock face may then also be used as the 0100-1200 time graduations of the inner or outer time ring.

In one preferred form, the fixed dial means includes a fixed outer annular dial provided about the outer periphery of the rotatable dial means. This allows for example the 0100-1200 time ring to be mounted on a fixed inner dial such as the clock face, whilst the 1300-2400 time ring may be mounted on the outer fixed dial. This provides for a more easily readable arrangement.

The time rings, instead of the location rings, may be provided on the rotatable dial means. In this case, the time graduations should be arranged anti-clockwise on the time rings.

In an alternative embodiment to an annular rotating dial means, the rotatable dial means may be a rotatable disc, which extends over the clock face of the timepiece, and is preferably transparent at its centre to allow the face and the hour and minute hands to be seen to tell the local time. This embodiment has the advantage that when the disc is to be rotated clockwise it may be mounted directly on the hour hand drive mechanism without needing intermediate gear wheels as would be required for example by an annular rotating dial. In this case, a separate hour hand is not necessarily required, as it may be drawn on the disc itself.

The rotatable dial means need not necessarily rotate clockwise, and may rotate anticlockwise. If so, then the time graduations on the time rings should be marked anti-clockwise, when they are provided on the fixed dial means, with the location rings on the rotatable dial means. If the time rings are on the rotatable dial means, then they may run clockwise.

In a further preferred embodiment, the timepiece has an exchangeable bezel thereon. This has the advantage that when for example the location rings are mounted on an outer fixed dial, that dial may be replaced by a further dial having different locations thereon for the GMT time zones.

Whichever embodiment is utilised, the time graduations 0100-1200 or 1300-2400 may be provided on either the inner or the outer time ring, and the geographical locations corresponding to the 0100-1200 or 1300-2400 GMT time zones may be on the inner or the outer location ring.

In a particularly preferred embodiment, the timepiece including means for indicating a time sector of the day. A time sector is a set period of the day, for example morning or afternoon or, more preferably and more advantageously, one of four quarters of the day. This allows the user to for example tell whether the local time indicated by the hands of the timepiece is 1100 or 2300, etc.

Preferably, the time sector indicating means is adjustable to provide the correct sector of the day for a location other than that for which the hour hand of the timepiece tells the correct time. Thus, if the user of the timepiece is interested in the local time of a particular location marked on one of the location rings, the user may set the time sector indicating means to show the time sector of that location. The user may then simply tell the local time in that place by noting the two time graduations of the two time rings which are opposite the location, and by then choosing the correct one of the two times by checking the time sector of that place from the time sector indicating means.

Preferably, two time sector indicating means are provided, one for indicating the sector of the day for the location for which the hour hand of the timepiece tells the correct time, and one for indicating the sector of the day in another location in a different time zone.

Where the indicating means indicates that it is one of four time sectors, the time sector indicating means may be driven to rotate through 90° once every six hours. In order to achieve this, the time sector indicating means may include a disc having four teeth about its periphery which are arranged, in a home position, to one side of the 12, 3, 6 and 9 o'clock positions, and the hour hand mechanism may include a disc thereon having two opposed teeth, the arrangement being such that, as the hour hand disc rotates, one of the two opposed teeth of the hour hand disc engages with one of the teeth of the disc of the sector indicating means once every six hours, to trip the sector indicating means to rotate through 90°. The time sector indicating means may include a dial, driven by the four-toothed disc, which has time sector information (e.g. appropriate graphics) thereon and which is located under the face of the timepiece, a portion of the dial having the correct time sector information being rotated into position beneath an opening in the timepiece face to show the time sector. Alternatively, the time sector indicating means may include a hand mounted above the face of the timepiece and driven by the four-toothed disc, the hand pointing to time sector information marked on the timepiece clock face.

As mentioned above, the rotatable dial means may be driven by the hour hand mechanism through for example gear means in the case of an annular dial or by being directly mounted to the hour hand mechanism in the case of a rotating disc. The invention may also however use a manually rotatable dial means, in which case the local GMT time of another location may be found by rotating the dial so that the location for which the timepiece hour hand gives the correct local time (which is usually the location of the timepiece) as marked one of the location rings is opposite to the correct time graduation of the time rings. Each of the other locations is then automatically opposite both its correct local time and a time twelve hours different, the correct one being obtainable in the same ways as for the previous embodiments. This embodiment has the advantage that no drive means are required for the rotatable dial.

The arrangement of an annular dial and a pair of quarter dial means (e.g. two of the time sector information dials discussed above), all driven by the same mechanism, i.e. the hour hand mechanism, is useful and inventive in itself,

without necessarily being used in a universal time indicator. Viewed from a further aspect, therefore, the present invention provides a timepiece having an hour hand mechanism, an inner fixed dial, a rotating outer annular dial and a pair of quarter dial means, the outer annular dial having teeth about its inner periphery, which engage with gear means driven by a multi-toothed wheel on the hour hand mechanism to rotate the outer annular dial, preferably once every twelve hours, and the pair of quarter dial means being driven to rotate through 90° once every six hours by a further wheel on the hour hand mechanism having a pair of opposed teeth thereon, the quarter dial means each including a wheel having four teeth thereon mounted slightly to one side of the 12, 3, 6 and 9 o'clock positions when the wheel is in its home position, one of the teeth of the two-toothed hour wheel engaging with one of the four teeth of the quarter dial discs every six hours to thereby trip the wheel and cause it to rotate 90°. The quarter dial means may include a rotating disc beneath the timepiece's clock face, or a hand on top of the clock face, as discussed above with reference to the world timepiece.

The use of a quarter dial means as discussed above is in itself a particularly advantageous feature of the present invention, and, viewed from a further aspect, the present invention provides a timepiece having a twelve hour time dial and time sector indicating means for indicating the correct quarter of the day. The quarters would be set at 0000-0600, 0600-1200, 1200-1800 and 1800-2400. This has the advantage that, although the twenty four hour time system is being used more and more, people still tend to prefer timepieces with standard twelve hour dials, and this further aspect of the invention allows such a standard twelve hour dial to be used to tell the time in the twenty four hour system. Further, the use of four time sectors is advantageous over for example two twelve hour time sectors, in that it avoids any ambiguity as to the correct time in the region of 1200 or 2400 hours. If only two sectors of 0000-1200 and 1200-2400 were used, the sector indicator might not trip to indicate the next sector at exactly 1200 or 2400 hours. Instead it might trip at any time in for example the first half hour after 1200 or 2400. Therefore, during this time, one would not be able to tell whether the correct time was just after 1200 hours or 2400 hours. In contrast, by this latter aspect of the present invention, one can always tell the correct 2400 hour time: If the time is just after 1200, then the timepiece will indicate either the second quarter (between 0600-1200) or the third quarter (between 1200-1800), depending on whether or not the advancing mechanism of the time sector indicator had been tripped, whilst if the time was just after 2400, then either the fourth quarter (between 1800-2400) or the first quarter between (0000-0600) would be indicated.

The means for indicating the correct quarter may take the form of the quarter dials means mentioned above in respect of the first and second aspects of the invention, and is particularly useful in situations in which the timepiece user is in an environment where the sun and moon cannot be seen, or the user is continually changing their position.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a plan view of the front face of a watch in accordance with a first embodiment of the present invention in which the hands show the local time in Hong Kong;
Fig. 2 shows the watch face of Fig. 1 at a different time;
Fig. 3 shows the watch face of Fig. 1 at another time and with the hands showing the local time at the GMT location;
Fig. 4 shows a second embodiment of the invention, in which the location names on the inner and outer dials of the city dial are interchanged;
Fig. 5 shows a third embodiment of the invention, which corresponds to that of Fig. 1, but does not include an annular outer hour dial;
Fig. 6 shows a fourth embodiment of the invention, which corresponds to that of Fig. 4, but does not include an annular outer hour dial;
Fig. 7 shows schematically a drive mechanism for use in the embodiments of Figs. 1 to 6;
Fig. 8 shows schematically a drive mechanism for a fifth embodiment of the invention;
Fig. 9 shows schematically a drive mechanism for a sixth embodiment of the invention;
Fig. 10 is a plan view of a watch case with a removable bezel, according to a sixth embodiment of the invention; and
Fig. 11 is a cross-section through line XI-XI of Fig. 10, showing how the removable bezel is attached to the watch case.

Referring to Fig. 1, a watch 1 comprises a watch face 2 with time graduations 1-12 marked clockwise thereon, an hour hand 3, a minute hand 4 and a watch mechanism for driving the hour and minute hands 3,4. The hands 3,4 tell the present time of a specific location, which is usually the location of the wearer.

The watch also includes a universal time indicator for telling the local GMT time of a number of locations worldwide. The universal time indicator comprises the time graduations 1-12 of the watch face 2 as an inner hour dial (inner hour ring), a rotating annular city dial 5 mounted about the watch face 2, and a fixed (i.e. non-rotating) outer hour dial 6 having time graduations 13-24 marked thereon (outer hour ring).

The city dial 5 rotates simultaneously with the hour hand clockwise once every twelve hours and the names of various cities, one for each of the 24 GMT time zones, are arranged on the city dial 5 on two 12 hour rings, an inner city ring 5a having cities in the 0100 to 1200 GMT time zones, and an outer city ring 5b having cities in the 1300 to 2400

GMT time zones. The two sets of twelve geographical place names are marked on their respective rings 5a,5b clockwise in accordance with their local GMT times, with cities which lie opposite each other on the two rings having local times 12 hours apart.

Each of the 13-24 time graduations of the outer dial 6 opposes the one of the 1-12 time graduations on the watch face 2 which has a twelve hour difference, I.e. the 13 graduation on the outer hour dial 6 opposes the 1 graduation of the watch face 2, etc.

When the city dial 5 is in the home position, with GMT at 2400 hours, all of the cities on the inner and outer city rings 5a,5b are aligned respectively with the time graduations on the inner hour dial (watch face 2) and outer hour dial 6 corresponding to their GMT time zone.

Thus, unlike prior art world timepieces, which have the cities marked one after the other on a twenty four hour ring, the present watch is distinguished in that it comprises two twelve hour (inner and outer hour) rings, and two twelve GMT zone (inner and outer) location rings.

The time in any of the locations on the city dial 5 may be obtained from the position of the location on the city dial 5 relative to the time graduations on the inner and outer hour dials 2,6.

The watch face 2 also includes openings 7 and 8 therein through which can be seen information 9 on upper and lower quarter dials 10 and 11 (see Fig. 7) mounted below the watch face 2. The quarter dials 10,11 rotate through 90° once every 6 hours to bring different information 9 in front of the openings 7,8 to indicate the "time sector" of the day.

A time sector is a quarter of the twenty four hour day, e.g. 0-6 hours (sector 1), 6-12 hours (sector 2), 12-18 hours (sector 3) and 18-24 hours (sector 4). By knowing the time sector, the wearer can determine whether it is for example one o'clock in the day or one o'clock at night, even in an environment where it may be difficult to distinguish day from night, such as at the North or South Poles or in an enclosed room, or in an environment whose position is constantly changing, such as in an aircraft, ship or satellite. The lower dial 11 may be set to provide the time sector for the location whose time is shown by the hour and minute hands 3,4, which is usually the location of the wearer. The upper dial 10 may be adjusted independently of the hour hand mechanism by pulling and rotating a setter 12 to give the correct time sector for a different location of particular interest to the wearer. As discussed below, the latter feature allows the time in this other location to be very easily obtained from the city dial 5.

In use, the local time of the wearer can be read from the standard hour and minute hands 3 and 4, and the present time sector can be read from the information 9 on the lower quarter dial 11, as viewed through the opening 8. The wearer can thus easily obtain the correct local twenty four hour time.

To tell the local GMT time in other locations, the city dial 5 is first set by pulling and turning a crown 13, so that the city for which the standard hour and minute hands are telling the correct time (which will usually be the city in which the wearer is located) is opposite to its correct local GMT time graduation on the watch face 2 or the hour dial 6. The other city names then automatically have the correct local GMT time opposite to them, and the wearer can read the local GMT time of these other cities around the world as discussed below.

Once the city dial is correctly set, the local GMT times of the other cities remain correct as the city dial 5 rotates with the hour hand 3, and the city dial 5 does not need to be reset again. This contrasts with some prior art systems, in which various dials, such as a twenty four hour dial had to be rotated each time the GMT of a particular city was sought.

For each city marked on the city dial 5, there will be two possible local GMT times associated with it - either that of the outer dial 6 or that on the watch face 2 (these two times being twelve hours apart). If the city of interest is the one for which the upper quarter dial 10 is set to give the correct time sector, then the correct one of the two times can be simply chosen based on the time sector shown in the upper opening 8. If this is not the case, then one of the following methods may be used to determine which of the two times is correct.

In a first method to read the local GMT time of a "target" city (different from the "local" city as shown by the hour and minute hands 3,4), the wearer identifies whether the local city lies on the inner or outer ring 5a,5b of the dial 5, and notes the local time as told by the hour and minute hands 3,4 (to know whether it is before or after noon, the wearer can check the information on the lower quarter dial 11 as seen through the opening 8 on the watch face 2).

The target city is next located. If it is on the same ring as the local city, a check is made as to whether the target city lies clockwise between the local city and the GMT sector of the city dial. If it does, then the hours are counted and added clockwise from the local city until the target city is reached. The local GMT time for the target city can then be simply read off. If the target city is counter-clockwise between the local city and the GMT sector of the dial 5, then the hours are counted and subtracted counter-clockwise until the target city is reached, and then the local GMT time for the target city is read.

If the target city is on the other city ring from the ring of the local city, then the city immediately opposite to the target city is noted, which will be on the same ring as the local city. The same clockwise/anticlockwise method above is then carried out to give the local GMT time for the opposed city, and the GMT time of the target city can then be simply obtained from the opposite hour marker to that found.

If the local time is on the GMT sector of the city dial 5 (i.e., in Fig. 1, is either GMT or Auckland), then the hours are counted and subtracted counter-clockwise to read off the time for the target city. If the target city is in the GMT sector of the city dial 5 (i.e., in Fig. 1, is either GMT or Auckland), then the hours are counted and added clockwise to read off

the time for the target city. In both cases, one first switches to the opposite city if the local city and the target city are not on the same location ring.

The following are examples using the above method and the watch of Fig. 1, in which the hands 3,4 are set to the local time (1100) in Hong Kong.

1. The Solomon Islands is on the same city ring 5a as Hong Kong, and lies clockwise between Hong Kong and GMT. Therefore, count and add the hours clockwise (1200, switch hour rings, 1300 and 1400) from Hong Kong until the Solomon I. is reached to give 1400 hours.

2. Moscow is on the same city ring 5a as Hong Kong, but lies anti-clockwise between Hong Kong and GMT. Therefore, count and subtract the hours anti-clockwise (1000-0600) from Hong Kong until Moscow is reached to give 0600 hours.

3. GMT is on the opposite ring 5b from the ring 5a of Hong Kong. The city opposite GMT is Auckland. As the target city is on the GMT sector of the city dial 5, count and add clockwise (1200-1500) from Hong Kong until Auckland is reached to give 1500 for Auckland, and so 0300 for GMT.

The following are examples in which the local time shown on the watch in Fig. 1 is taken to be 2300 hours:

4. Monrovia is on the other city ring 5b from Hong Kong 5a. The location opposite Monrovia is Solomon I, which is clockwise between Hong Kong and GMT. Therefore, count and add the hours clockwise (2400, switch hour rings, 0100,0200) until the Solomon I. is reached to give 0200 hours for the Solomon I., and so 1400 hours for Monrovia.

5. Honolulu is on the other city ring 5b from Hong Kong. The location opposite is Cairo, which is anti-clockwise between Hong Kong and GMT. Therefore, count and subtract the hours (2200-1700) until Cairo is reached to give 1700, and so 0500 for Honolulu.

The following examples refer to Fig. 2, in which local Hong Kong time is 0300 hours:

6. Paris is on the same ring 5a as Hong Kong and lies anti-clockwise between Hong Kong and GMT. Therefore, count and subtract the hours anti-clockwise (0300, 0200, 0100, switch rings, 2400-2000) until Paris is reached to give 2000 Hours.

7. GMT is on the other ring 5b from Hong Kong. The city opposite GMT is Auckland. As it is on the GMT sector of the city dial 5, count and add clockwise (0400-0700) from Hong Kong until Auckland is reached to give 0700 for Auckland, and so 1900 for GMT.

The following examples refer to Fig. 3, in which local time is GMT (rather than Hong Kong) and is 0700 hours:

8. New York is on the same ring 5b as GMT. Therefore, as the local time is for the GMT location, count and subtract the hours (0600-0200) until New York is reached to give 0200 hours.

9. Dubai is on the other ring 5b from GMT. The opposite location is Los Angeles. Therefore, as the local time is for the GMT location, count and subtract the hours (0600-0100, switch hour rings, 2400, 2300) from GMT until Los Angeles is reached to give 2300 hours, and so 1100 hours for Dubai.

An alternative method of reading the watch is to as before find the target city. If it is on the same city ring as the local city, then count and add the hours clockwise from the local city until the target city is reached. If the counting stops at or before the GMT sector, then read off the local GMT time for the target city when the city is reached. If the counting passes beyond the GMT sector, then switch to the other set of time graduations and continue counting and adding until the target city is reached, at which point the local time GMT can be read.

If the target city is on the other city ring from the local city, then note the city immediately opposite to the target city, and use the same method as in the last paragraph to read the local GMT time for this opposite city. The target city local time can then be read from the opposite hour dial graduation.

If the local time is on the GMT sector of the city dial 5 (i.e., in Fig. 1, is GMT or Auckland), and the target city on the same ring, then switch to the other set of time graduations and count and add clockwise to read off the local GMT time for the target city. If the target city is on the other city ring, find the local GMT time for the opposite city through the procedure in the last sentence, and then read the local GMT time from the other hour dial for the target city.

If the target city is on the GMT sector of the city dial 5 (i.e., in Fig. 1, is GMT or Auckland), then count and add clock-

wise to read off the time of the target city.

This may be termed the "always clockwise" method, as the principle is always to count and add clockwise for a target city on the same ring, and to change course for the hour index ring when the GMT sector is passed.

The following are examples of this method, referring to Fig. 1, in which it is 1100 local time in Hong Kong:

10. Moscow is on the same ring 5a as Hong Kong. Therefore, count and add clockwise (1200, 1300, 1400, 1500) until the GMT sector is reached at 1500 hours, then change from the outside dial to the inside dial, and continue counting (0400, 0500, 0600) until Moscow is reached at 0600 hours.

11. Honolulu is on the other city ring 5b. Therefore take the opposite city, Cairo, and count and add clockwise from the local city Hong Kong until the GMT sector is reached at 1500, and then change to the other hour dial 2 and continue counting until Cairo is reached at 0500, so that Honolulu is at 1700.

12. Taking Honolulu again, but assuming that Hong Kong is at 2300 hours, take Cairo again, and count and add from Hong Kong until the GMT sector is reached at 0300, then switch dials and continue counting until Cairo is reached at 1700, so that Honolulu is at 0500.

The names of various cities at the 24 GMT time zones are listed below, and may be used instead of those shown on the watches in the drawings:

City Code	City Name	GMT Time Zone
C.01	Paris Rome Berlin Geneva	0100
C.02	Cairo Istanbul Jerusalem Beirut	0200
C.03	Moscow Kuwait Baghdad Aden	0300
C.04	Dubai Abu Dhabi Mauritius Rednon	0400
C.05	Bombay New Delhi Sri Lanka Kashmir	0500
C.06	Decca Calcutta Colombo	0600
C.07	Hanoi Bangkok Jakarta	0700
C.08	Honk Kong Taipei Beijing Manila Singapore	0800
C.09	Tokyo Adelaide Seoul New Guinea	0900
C.10	Sydney Melbourne Guam Saipan	1000
C.11	Solomon I. Noumea	1100
C.12	Auckland Fiji Tonga Marshall I.	1200
C.13	Midway Samoa	1300
C.14	Honolulu Tahiti	1400

C.15	Anchorage Alaska Port Rupert Adamstown	1500
C.16	Los Angeles Vancouver San Francisco	1600
C.17	Denver Edmonton	1700
C.18	Chicago Houston Mexico Honduras	1800
C.19	New York Miami Montreal Toronto	1900
C.20	Bermuda Caracas	2000
C.21	Rio De Janiero Buenos Aires	2100
C.22	Fernando do Noronha	2200
C.23	Monrovia Azores	2300
C.24	GMT London Lisbon Iceland	2400

A point to note is that the wearer's local time is usually shown both by the standard hour and minute hands, and also by a location on the city dial 5. In prior world watches, the wearer's location on the universal indicator was often not at the same position as that to which the standard hour hand pointed, and this could be disconcerting. In this embodiment, however, as the cities rotate with the hour hand, the wearer's location as marked on the city dial 5 follows the hour hand 3 about the watch face 2 (see Figs. 1 and 2).

Fig. 4 shows a second embodiment of the present invention, which is identical to Fig. 1, except that the arrangement of the cities on the two rings 5a,5b of the city dial 5 are interchanged, i.e. the inner ring 5a houses the cities in the 1300-2400 time zones, and the outer ring 5b houses the cities in the 0100-1200 time zones. In this case, the outer dial 6 is marked with time graduations 1-12 instead of 13-24, and the watch face 2 (as the inner hour dial) is marked with the time graduations 13-24. In order to tell the wearer's local time using the standard hour and minute hands 3 and 4, standard time graduations 1-12 may also be marked on the watch face 2, or the wearer may use the graduations on the outer dial 6 (the hands may be extended to make this easier if desired).

Figs. 5 and 6 show further alternative embodiments of the invention, which are identical to Figs 1 and 2 respectively, except that the outer hour dial 6 has been removed, and the hour graduations from that dial 6 have instead been marked on the watch dial 2 as inner and outer hour rings.

In another embodiment including the outer hour dial 6, both the inner and outer hour rings could be provided on the outer hour dial 6.

As a further alternative to the above embodiments, the positions of the place names and the 1-24 time graduation markings may be interchanged, with the 1-24 time graduation hour markings on the rotating dial 5, with the location names on the fixed watch face 2 and, if included, the outer dial 6. In these embodiments, the time graduations would need to run anti-clockwise. Further, as the 1-12 time graduations of the universal indicator would now move, they could not be used with the hands 3,4, and so a further set of 1-12 graduations would be required on the watch face 2 for the hands 3,4.

A suitable driving mechanism for the above watches is shown in Fig. 7. This shows a mechanism for driving three different dial mechanisms from a single power source - i.e. the hour hand wheel 13 which moves the hour hand 3.

The three dials detailed are upper and lower quarter dials 10,11 and an outer dial 14 which corresponds to the rotating city dial 5 of the above embodiments. This figure does not show the outer hour dial 6 of the above first embodiment, which is fixed and could for example be part of the watch bezel.

Hour hand wheel 13 rotates clockwise once every twelve hours and comprises upper and lower wheels 13a and 13b, which drive respectively the quarter dials 10 and 11 and the outer dial 14. The upper wheel 13a is smaller than the lower wheel 13b and has a pair of opposed teeth 15 thereon at 12- and 6-o'clock when in the home position. The lower wheel 13b has teeth continually about its periphery.

Upper and lower quarter dials 10 and 11 each comprise a dial face 16 on which the information 9 as to the time-sector of the day is marked. A smaller disk 17 is mounted below the dial face 16 and has four teeth 18 thereon positioned slightly to the right of the 12-, 3-, 6-, and 9- o'clock positions when the disc 17 is in its home position.

These teeth 18 are in the same plane as the teeth 15 of the hour hand upper wheel 13a, and gear with the latter once every six hours as the hour wheel 13 rotates.

When one of the two teeth 15 of the upper hour wheel 13a begins to gear in with one of the four teeth 18 of the quarter dials 10,11 at for example about 1130 hours, a rotating mechanism not shown, but which may be similar to that of a date-advancing arrangement, starts to set in for each quarter dial 10,11. Soon after 1200 hours, the rotating mechanism of each quarter dial 10,11 is triggered to advance the dials 10,11 by one quarter of a cycle. Thus, the correct information 9 on the dial face 16 of the quarter discs 10,11 is visible through the corresponding opening 8,9 on the watch face 2 to provide the time sector of the day.

In Fig. 7, the upper quarter dial 10 includes a lever 19 operated by the upper quarter dial setter 12. By pulling and turning the setter 12, the dial 10 may be advanced quarter by quarter freely from the hour hand 3 to allow for suitable adjustment. With this system, the upper quarter dial 10 can show the time sector of a location other than that in which the wearer is located (the time sector of which may be shown by the lower quarter dial 11). Therefore, if there is a second location of particular importance to the wearer, the upper quarter dial 10 can be set to show the time sector of that place. As mentioned previously, this allows the wearer to very quickly know the exact time in that other place: The wearer need only look for the location of that place on the city dial, note the two times associated with that location on the watch face 2 and on the outer dial 6 (which will be 12 hours different from one another), and then choose the correct time from the two based on the upper quarter dial 10 time sector information 9.

The outer dial 14 has teeth around its inner peripheral edge and is geared through these teeth and by connecting gears 21 and 22 to the multi-toothed lower wheel 13b of the hour wheel 13. The overall gearing of the outer dial 14, connecting gears 21,22 and the multi-toothed lower hour wheel 13b is such that the outer dial 14 moves at the same speed as the hour hand 3, i.e. one full rotation every twelve hours.

Instead of using quarter dials 10,11 with dial faces 16, it would be possible to replace the dial faces 16 by hands 23. Each hand 23 would be mounted by a shaft extending through the watch face 2 to lie above the watch face 2 and point to time sector information written onto the watch face 2 itself.

Fig. 8 shows an alternative mechanism to that of Fig. 7 for a fifth embodiment of the invention, in which there is only one connecting gear 24, which drives the outer dial anti-clockwise, but is geared so that the outer dial still rotates once every twelve hours. In this embodiment, when the cities are on the rotating outer dial 14 as in the city dial 5 of Fig. 1, the hour graduations 1-12 and 13-24 should run anti-clockwise. In this case, the 1-12 hour graduations of the universal time indicator could not be used with the hour and minute hands 3,4, and so a second set of clockwise 1-12 time graduations would be needed for the hands. When the time graduations are on the rotating dial 14 and the locations are on the fixed inner and/or outer dials (e.g. dials 2 and 6 of Fig. 1), the time graduations should run clockwise.

Fig. 9 shows an alternative mechanism to that of Fig. 7 for a sixth embodiment of the present invention, in which the "outer dial" 14 of Fig. 7 is driven directly from the hour wheel 13, without using intermediate connecting gears 21,22 or 23. With this arrangement, the outer dial does not take the form of an annular ring 14 as in Figs 1 and 7, but rather takes the form of a disc 24 mounted to the hour hand shaft and extending over the whole of the watch face 2. The disc 24 is transparent at the centre to allow the watch face 2 to be seen, and may be opaque at its peripheral edge 24a, where the required geographical locations or time graduations are marked. In this case, the hour hand 3 of the watch may be removed, and instead, a hour hand may be marked upon the transparent surface of the disc 24. This does however have the disadvantage that the position of the hour hand relative to the 24 marked locations is fixed, and so the local times in the other locations will only be correct when the watch hands are used to tell the time of one particular location.

Figs. 10 and 11 show a further embodiment of the invention which includes an exchangeable bezel 25 mounted on the watch 1 by anchoring inserts 26 which pass through holes 27 in flanges 28 of the bezel and extend into holes 29 in lugs 30 of the watch case 31. The holes 29 are of inverted cone shaped configuration, and the inserts 26 include retractable friction springs 32 which are biased outwardly to engage with the sides of the holes 29 to provide a good anchor.

This arrangement allows the wearer the choice of various designs of bezel. When mounting the bezel, it is placed on top of the watch case 31 with the holes 27 of the bezel 25 coinciding with those 29 of the lugs 30. The anchoring inserts 26 are then forced into the holes 29 of the lugs 30, with the friction springs 32 gripping the sides of the holes 29 firmly. As the holes 29 in the lugs are cone-shaped, the inserts 26 do not easily fall out. When removing the bezel, the watch is placed face down on to a suitable holder (not shown), and the anchoring inserts are forced out by means of a driver also of inverted cone shape.

This arrangement is particularly suitable for use in embodiments in which the time graduations are on the rotating

dial, and the geographical locations fixed, as the geographical locations may then be marked on the exchangeable bezel, and the wearer may choose from a number of different bezels having different locations thereon for example from the above table.

The above mechanism of Fig. 7 is a particularly useful mechanism for driving three separate elements irrespective of the information or markings mounted on the elements, and so another aspect of the invention resides in the mechanism of Fig.7 itself, in which the upper and lower quarter dials or hands and the outer dial have any desired information or markings on them and are used for any suitable purpose.

The use of the quarter dial 11 is also in itself a particularly advantageous feature, and the present invention also resides in the use of such a quarter dial in a timepiece. The twenty four hour time system is being used more and more, but people still tend to prefer timepieces with standard twelve hour dials. An advantage of the quarter dial is that it allows a standard twelve hour dial to be used to tell the time in the twenty four hour system. Further, the use of four time sectors is advantageous over for example two twelve hour time sectors, in that it avoids any ambiguity as to the correct time in the region of 1200 or 2400 hours. For example, if a two sector system were employed (0000-1200 and 1200-2400), the sector indicator might not trip to indicate the next sector at exactly 1200 or 2400 hours. Instead it might trip at any time in for example the first half hour after 1200 or 2400. Therefore, during these time periods, one would not be able to tell whether the correct time was just after 1200 hours or 2400 hours. In contrast, by the present invention, one can always tell the correct time: If the standard hour and minute hands give the time as just after 1200, then the quarter dial will indicate either the second sector (between 0600-1200) or the third sector (between 1200-1800), depending on whether or not the advancing mechanism for the quarter dial has been tripped, whilst if the time was just after 2400, then the quarter dial would indicate either the fourth time sector (between 1800-2400) or the first time sector (between 0000-0600).

The quarter dial is particularly useful in situations in which the timepiece user is in an environment where the sun and moon cannot be seen, or in which the user is continually changing their position.

The above are merely preferred embodiments of the invention, and various alternatives and variations on the above embodiments are possible. For example, the city dial 5 may be manually rotated instead of being rotated by the hour hand mechanism. In this case, when the time in another location is required, the wearer moves the city dial manually until the location for which the hands 3,4 tell the present time, usually the city in which the wearer is located, lies opposite to the hour hand. The wearer may then determine the time in another location by one of the methods discussed above. Further, one or both of the upper and lower quarter dials may be omitted. The invention is not limited to watches, and may be used in any timepiece.

Claims

1. A timepiece for providing the local GMT time in a number of locations worldwide, comprising:

   a hour hand;
   fixed dial means;
   rotatable dial means;
   time graduation means comprising inner and outer time rings, with time graduations 0100-1200 being arranged on one of the time rings and time graduations 1300-2400 being arranged on the other of the time rings; and
   location indicating means comprising inner and outer location rings, a location for each of the GMT time zones 0100-1200 being provided on one location ring and a location for each of the GMT time zones 1300-2400 being provided on the other location ring;
   said two time rings or said two location rings being provided on said rotatable dial means, with the other two of the rings being provided on the fixed dial means.

2. The timepiece of claim 1, wherein the rotatable dial means is driven manually.

3. The timepiece of claim 1, wherein the rotatable dial means is driven by the hour hand drive mechanism of the timepiece to rotate once every twelve hours.

4. The timepiece of claim 1, 2 or 3, wherein the fixed dial means includes an inner fixed dial, and the rotatable dial means is an annular dial located about the inner fixed dial.

5. The timepiece of claim 1, 2 or 3, wherein the rotatable dial means is a rotatable disc.

6. The timepiece of claim 5, wherein the rotatable disc is transparent at its centre to allow an inner fixed dial of the fixed dial means to be seen.

7. The timepiece of claims 3 and 6, wherein the rotatable disc is driven clockwise and the hour hand is marked on the rotatable disc.

8. The timepiece of any preceding claim, wherein the rotatable dial means rotates clockwise.

9. The timepiece of any of claims 1 to 7, wherein the rotatable dial means rotates anticlockwise.

10. The timepiece of any preceding claim, wherein the location rings are on the rotatable dial means and the time graduation rings are on the fixed dial means.

11. The timepiece of any of claims 1 to 9, wherein the time graduation rings are on the rotatable dial means and the location rings are on the fixed dial means.

12. The timepiece of any preceding claim, wherein the fixed dial means includes a fixed outer annular dial provided about the outer periphery of the rotatable dial means.

13. The timepiece of any preceding claim, wherein the timepiece has an exchangeable bezel thereon.

14. The time piece of any preceding claim, wherein the inner time ring has the time graduations 1-12 thereon, and the inner location ring has the geographical locations corresponding to the 0100-1200 GMT time zones thereon.

15. The timepiece of any preceding claim, including means for indicating a time sector of the day.

16. The timepiece of claim 15, wherein the time sector indicating means is adjustable to provide the correct sector of the day for a location other than that for which the hour hand of the timepiece tells the correct time.

17. The timepiece of claim 15 or 16, wherein two time sector indicating means are provided, one for indicating the sector of the day for the location for which the hour hand of the timepiece tells the correct time, and one for indicating the sector of the day in another location in a different time zone.

18. The timepiece of any of claims 15, 16 or 17, wherein the time sector indicating means is driven to rotate through 90° once every six hours.

19. The timepiece of claim 18, wherein the time sectors indicated are from 0000-0600, 0600-1200, 1200-1800 and 1800-2400.

20. The timepiece of claim 18 or 19, wherein the time sector indicating means includes a disc having four teeth about its periphery arranged, in a home position, to one side of the 12, 3, 6 and 9 o'clock positions, and the hour hand mechanism includes a disc thereon having two opposed teeth, the arrangement being such that, as the hour hand disc rotates, one of the two opposed teeth on the hour hand disc engages with one of the teeth on the disc of the sector indicating means once every six hours, to trip the sector indicating means to rotate through 90°.

21. The timepiece of any of claims 15 to 20, wherein the time sector indicating means includes a disc having time sector information thereon.

22. The timepiece of any of claims 15 to 20, wherein the time sector indicating means includes a hand mounted above the face of the timepiece.

23. A timepiece having an hour hand mechanism, an inner fixed dial, a rotating outer annular dial and a pair of quarter dial means, the outer annular dial having teeth about its inner periphery, which engage with gear means driven by a multi-toothed wheel on the hour hand mechanism to rotate the outer annular dial once every twelve hours, and the quarter dial means being driven to rotate through 90° once every six hours by a further wheel on the hour hand mechanism having a pair of opposed teeth thereon, the quarter dial means each including a wheel having four teeth thereon mounted slightly to one side of the 12, 3, 6 and 9 o'clock positions when the wheel is in its home position, one of the teeth of the two-toothed hour wheel engaging with one of the four teeth of the quarter dial discs every six hours to thereby trip the wheel and cause it to rotate 90°.

24. A timepiece having a twelve hour time dial and means for indicating the correct quarter of the day.

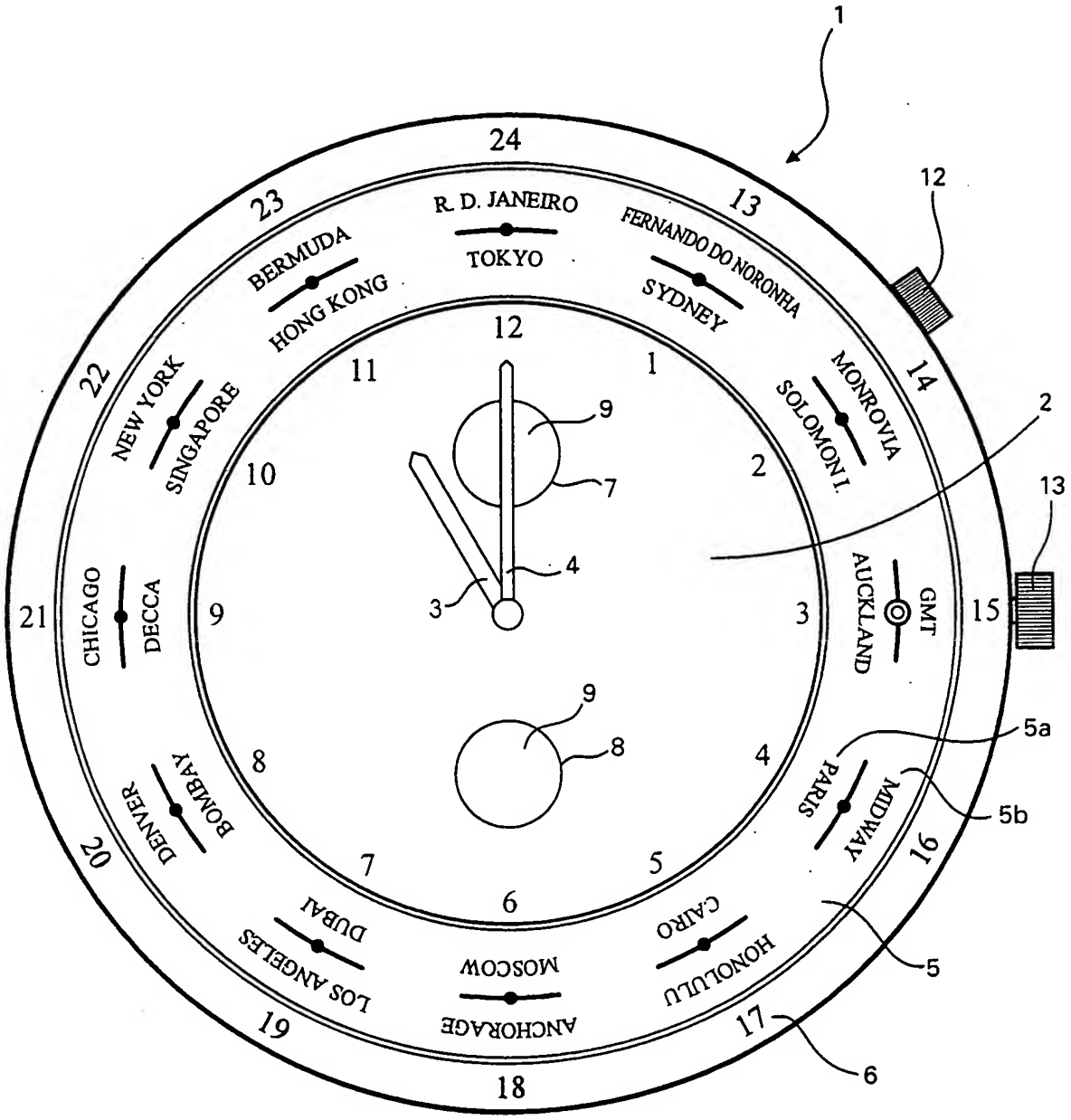
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FIG. 1

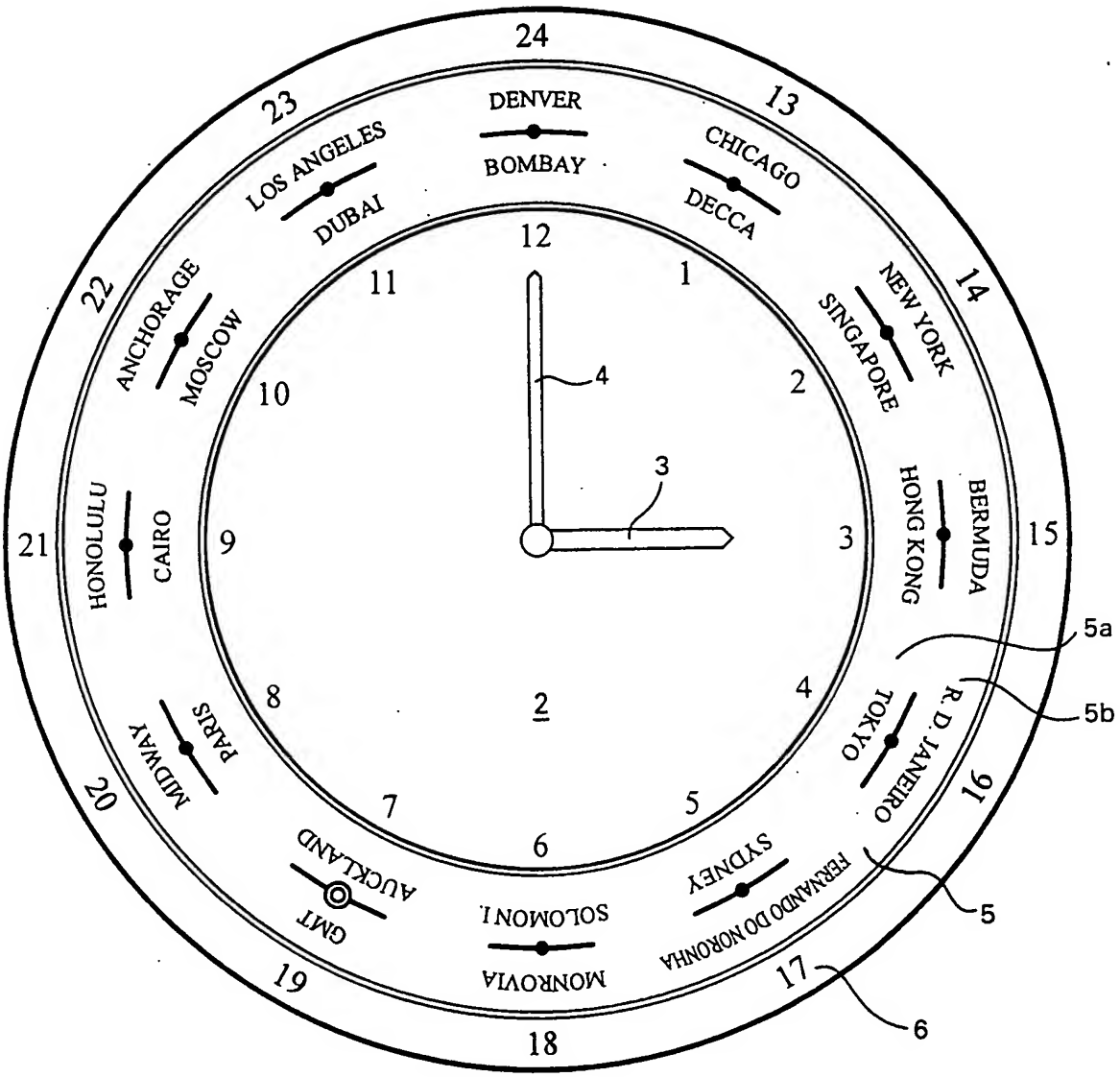
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FIG. 2

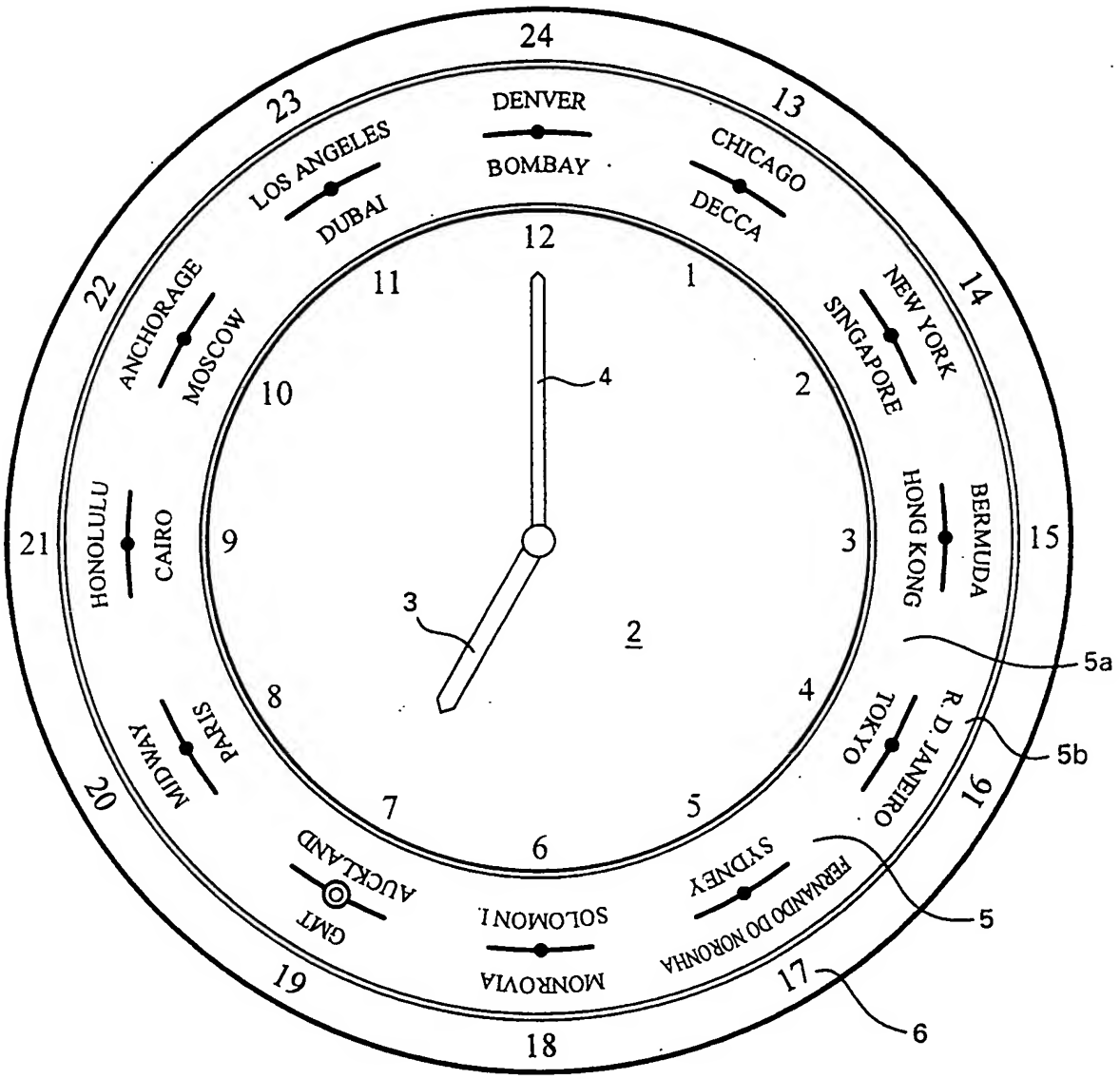
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FIG. 3

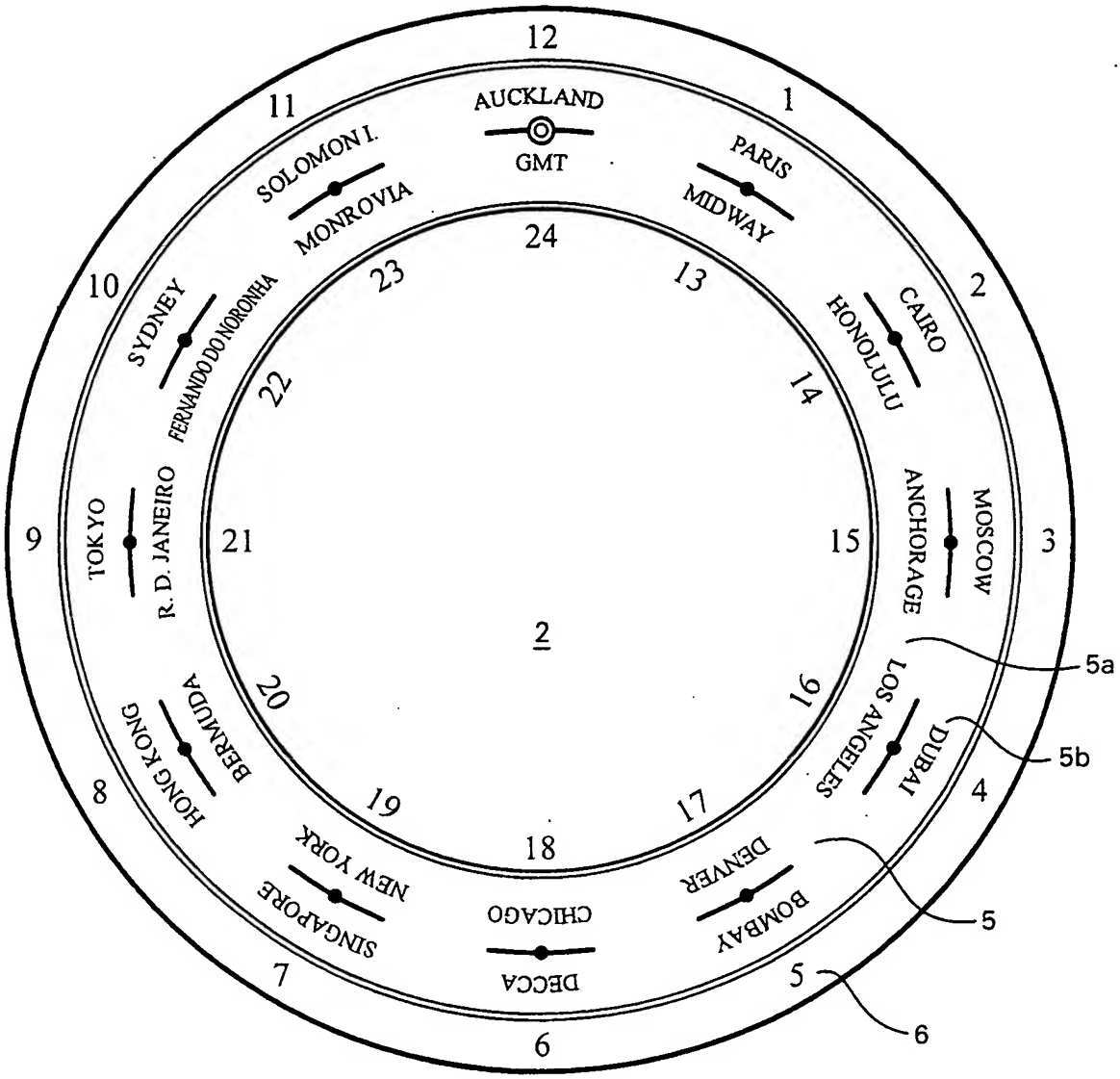
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FIG. 4

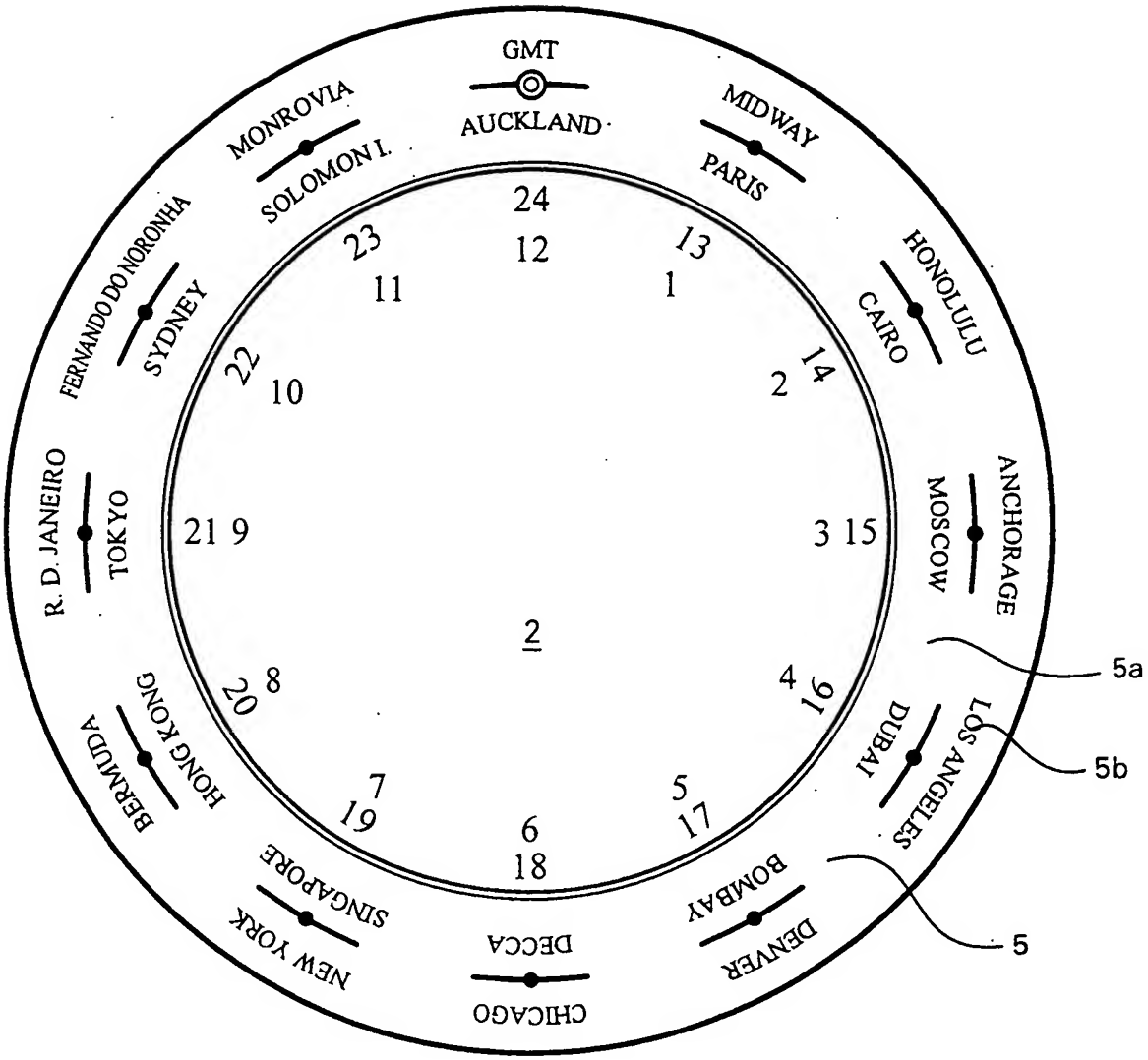
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FIG. 5

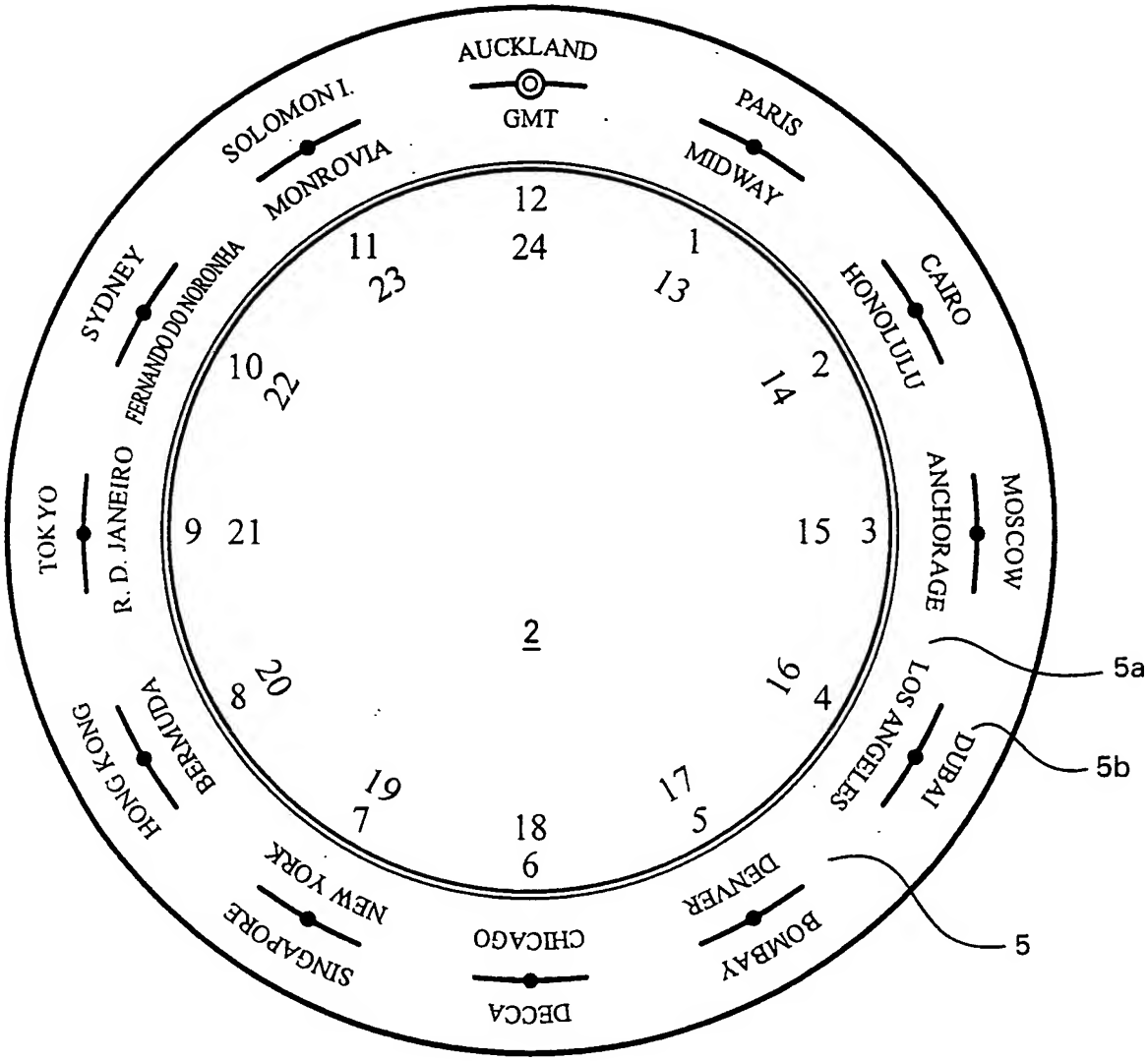
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FIG. 6

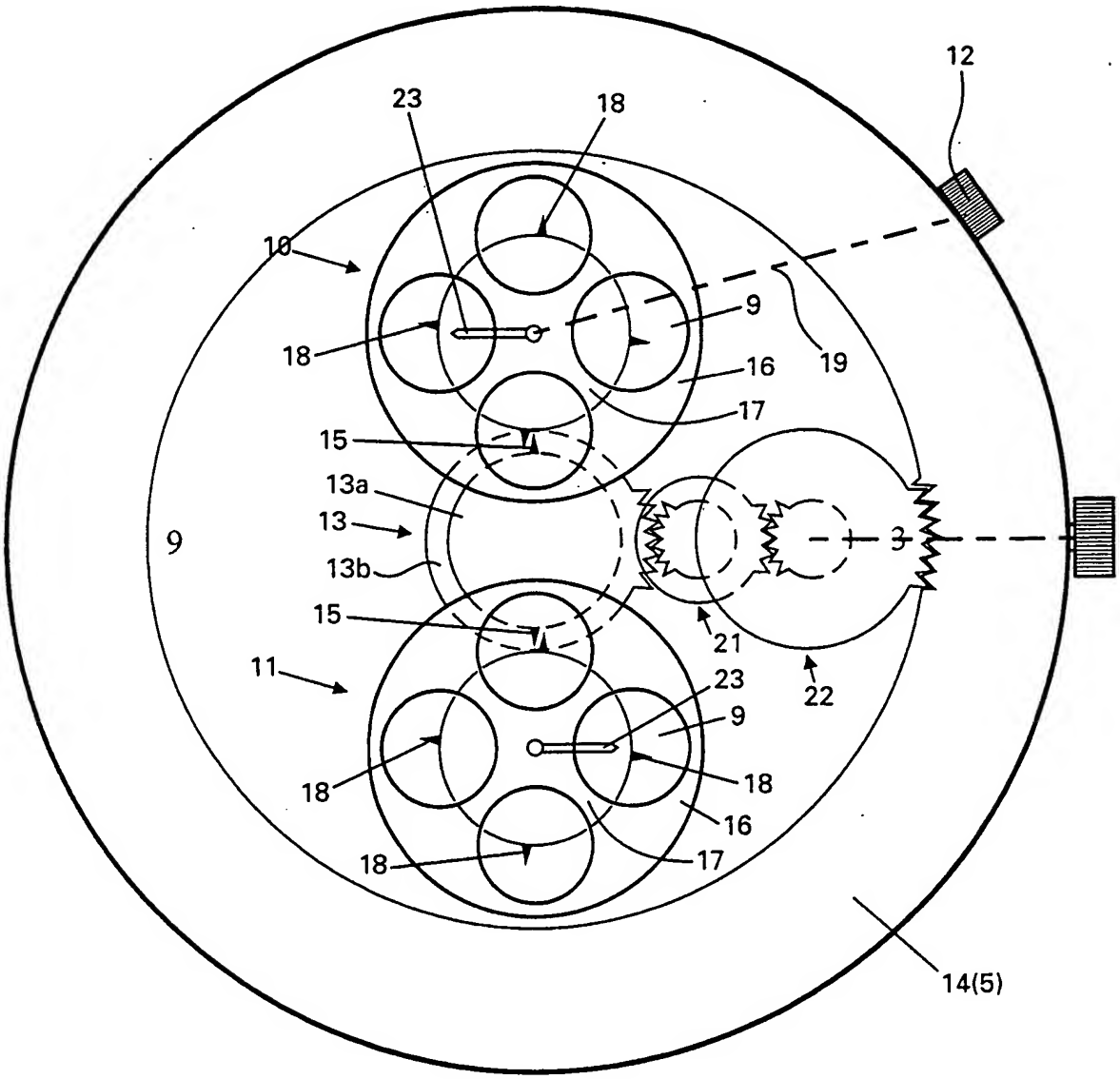
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FIG. 7

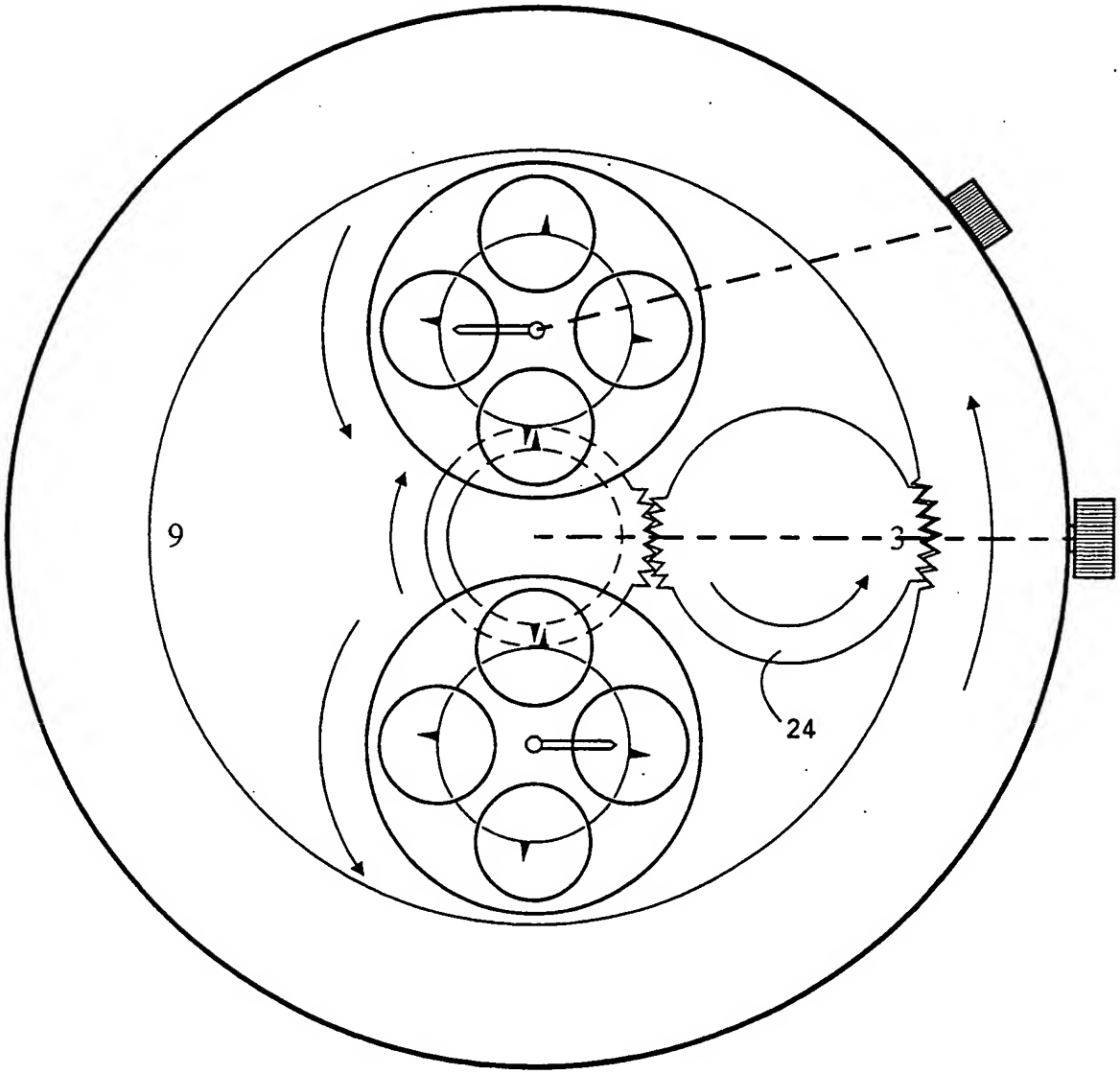

FIG. 8

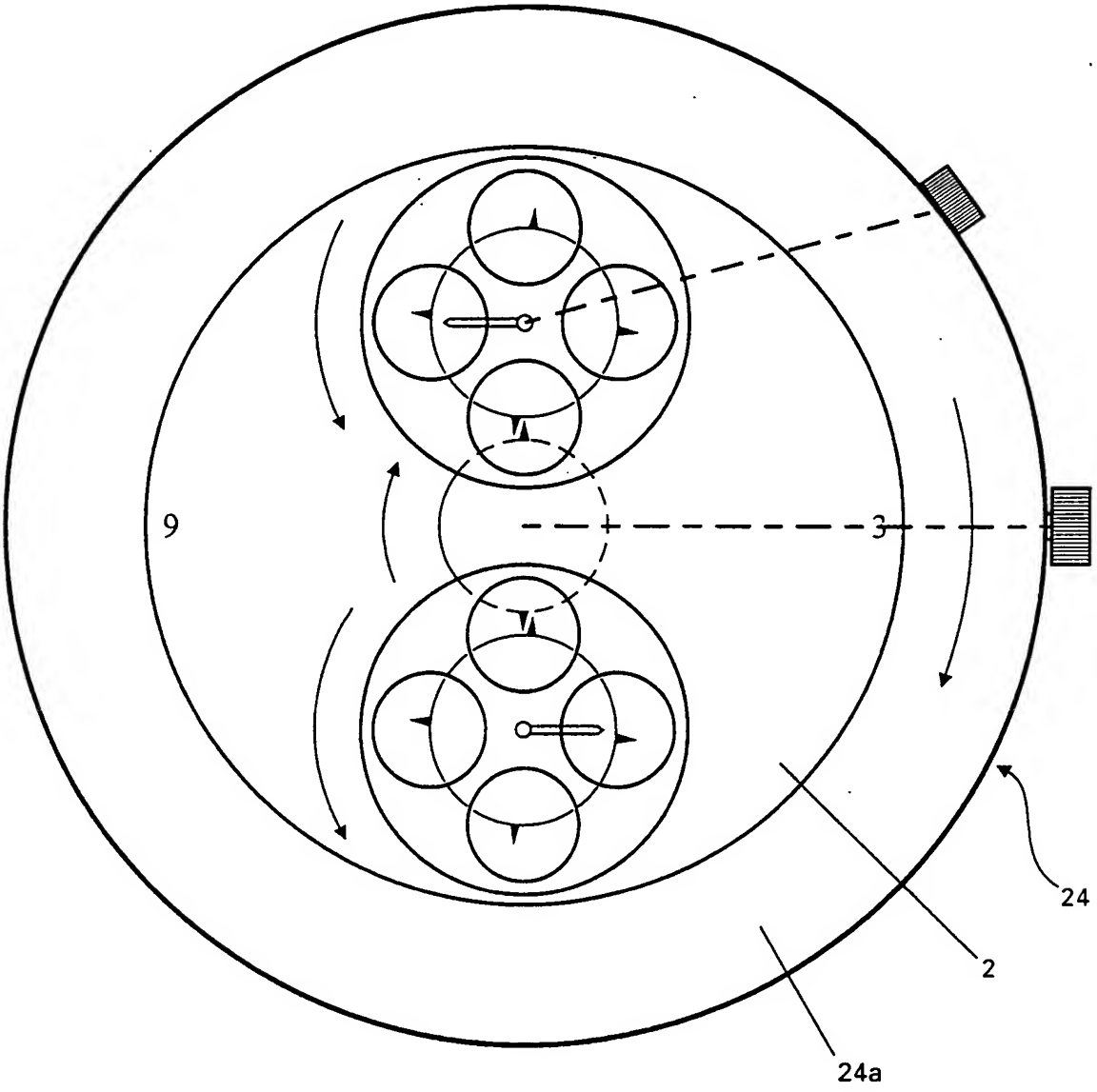

FIG. 9

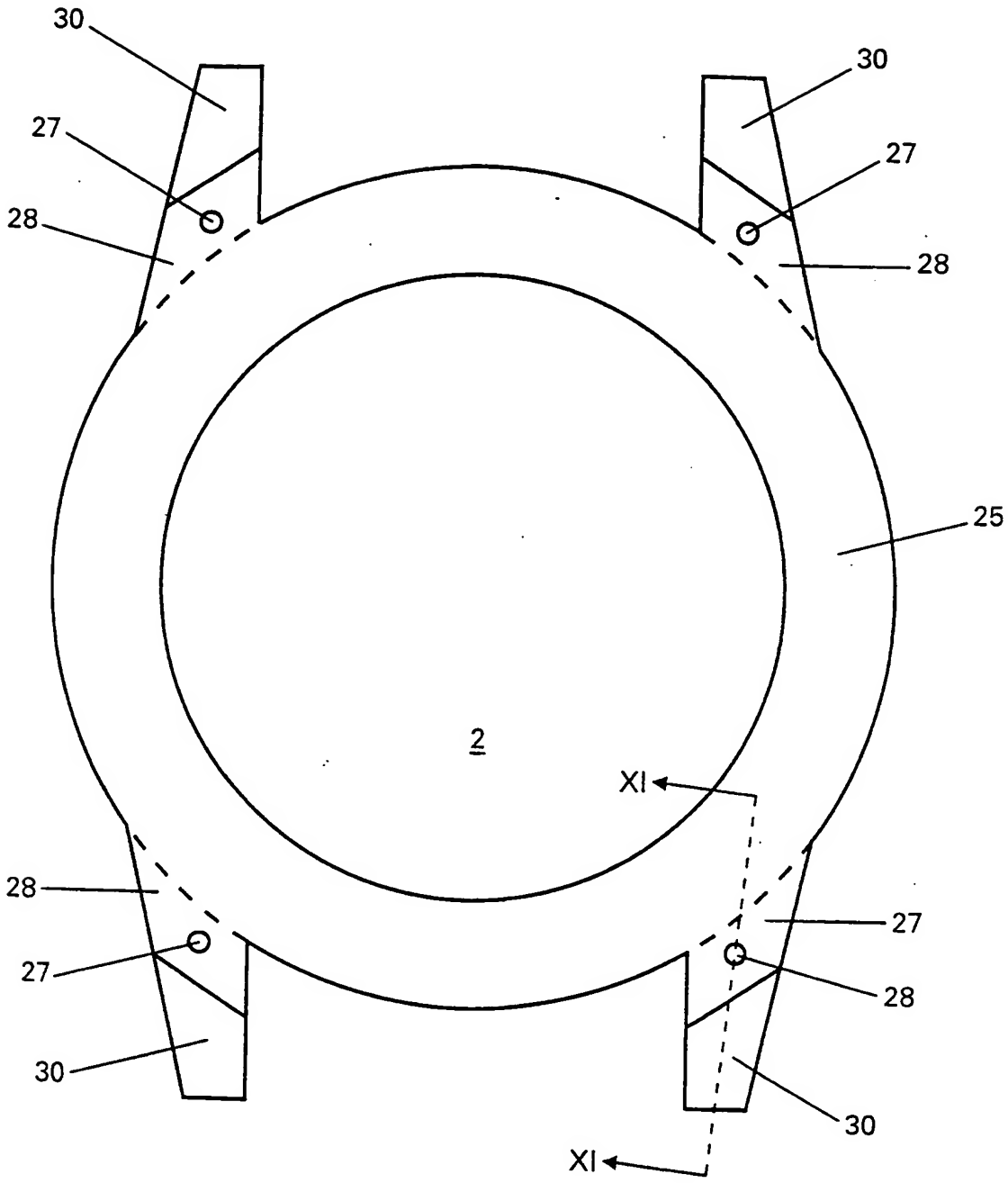

FIG. 10

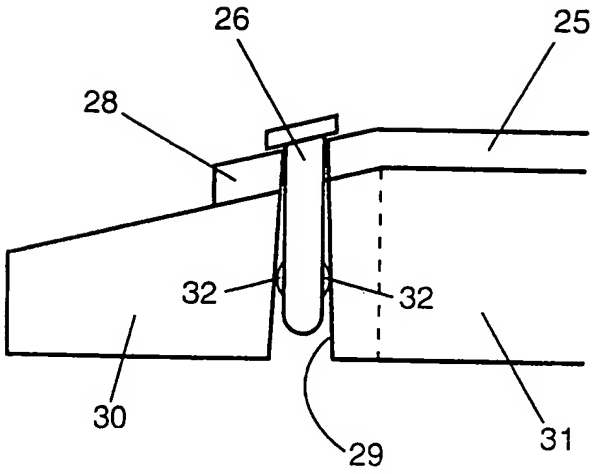

FIG. 11

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 30 7392

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE-A-38 41 440 (ZIMMERMANN) * column 3, line 45 - column 5, line 15; figure 1 *	1,3,5,9, 11,12	G04B19/22
X	US-A-1 676 000 (WHITMAN) * page 1, line 64 - page 3, line 64; figures *	1,3,5,8, 10,12,14	
A	CH-A-270 085 (COTTIER) * page 1, line 1 - line 10 *	1,2	
A	CH-A-273 133 (PRINS) * page 1, line 1-6 *	7	
A	GB-A-443 953 (PEACH) * page 3, line 54 - line 87 *	1,8,10, 12	
A	US-A-3 472 021 (HARAKAWA) * the whole document *	1,4-6,8, 10	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G04B
A	FR-A-1 110 428 (ROUSSEL) * page 2, left column, line 30 - line 40; figures 1,2 *	1,5,6,8, 10,12	
A	FR-A-2 377 057 (PASQUIER) * claim 1 *	13	
A	US-A-1 807 497 (SPECIALE) * figure 1 *	1,15	
A	EP-A-0 389 739 (LE PHARE-JEAN D'EVE S.A.) * abstract; figure 1 *	15,18, 19,22	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 March 1996	Pineau, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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